Chapter 10

Structure Maintenance Program

10.0 Introduction

Description

Maintenance plays an essential and integral role in the long-term life of structures. Structures left to deteriorate without timely maintenance treatment will likely require more costly treatments sooner than those properly maintained. Some of the common types of highway structures include:

- Bridge--a structure, which carries traffic over a watercourses such as a canyon, stream, dry wash or slough.
- Overpass--a structure, which carries traffic over an intersecting highway or railroad.
- Underpass--a structure, which carries traffic under an intersecting highway or railroad.
- Viaduct--a long structure crossing over several facilities of approximately the same importance, (city streets, railroads, roads; also a structure which carries traffic along a steep hillside).

Bridge Inspection Program

Bridges are designed and constructed in accordance with MDT and AASHTO specifications. This is accomplished through the application of stringent design criteria and construction specifications. Nevertheless, structural elements deteriorate over time and may eventually present a hazard to bridge users. A systematic program of bridge inspection is necessary to detect structural problems and minimize the probability of a structure failure.

There are two bridge inspection programs:

- District bridge inspections that meet the National Bridge Inspection Standards (NBIS).
  Congress enacted legislation requiring the establishment of national standards. Through the Federal Highway Administration, specific criteria known as the National Bridge Inspection Standards (NBIS) were established.
- Inspections performed by maintenance personnel.

Deficiencies in bridges are reported to the MDT Bridge Maintenance Engineer through the bridge inspection program. Deficiencies discovered during maintenance inspections are reported to the Bridge Engineer through the Area office. Bridge inspection reports

should be reviewed and brought to the attention of the affected section to correct deficiencies.

Purpose

MDT's goal is to maintain bridges in a manner that provides a safe roadway, preserves and extends the state's investment, maintains the functional condition and retards future deterioration by providing the appropriate preventive maintenance treatment. The Department's objective is to maintain structures to, as near as possible, the standards to which they were constructed.

Timing of Maintenance

Routine maintenance inspections should include monitoring the following items for deficiencies. Deficiencies found during inspections should be corrected in a timely manner.

- Damage from vehicle accidents or high load hits.
- Bridge deck and joint deterioration
- Materials/debris accumulated around piers and abutments.
- Removing trees or brush growing under or within 30 feet of structures.
- Plugged or partially plugged deck drains.
- Damaged or missing bridge rail.
- Lack of paint or preservative on steel, wood or concrete.
- Vegetation that limits sight distance.
- Cleaning and maintenance of rocker plates and bearings.
- Other items as noted on the bridge inspection sheet or by the Bridge Maintenance Engineer.

Approvals

A number of environmental and access permits must be addressed for bridge inspection, maintenance, and/or repairs (i.e. railroads, adjoining landowners and environmental permits.) Then only the Bridge Bureau can approve asphalt overlays on structures.

Documentation

Documentation should be in accordance with activity reporting outlined in the Maintenance Management System Manual. If special documentation is required, it will be included under the correct activity.

Resources

Bridge Inspection Manual
Bridge Maintenance Inspection Manual
Bridge Inspection Reports
MDT Environmental Best Practices
Maintenance Management System Manual

10.1 Maintenance and Repair of Structures (MMS 4101-4113)

Activity Description

This activity is the restoration and/or repair of structures. Maintenance and repair of structures may include, but are not limited to, the following activities:

- Repairing damage or deterioration in various bridge components.
- Removing debris and drift adjacent to piers.
- Cleaning drains.
- Cleaning and painting timber bridge rails.
- Tightening or replacing bolts and nuts.
- Repairing concrete bridge deck surface.
- Replacing joint material.
- Repairing or replacing bridge rail, curb, or posts.
- Adjusting height of bridge after settlement.
- Repairing and replacing timber stringers, caps, decks and/or piles.

Purpose

Maintenance of structures is necessary for the public safety, structural integrity and protection of the state's capital investment.

Timing of Maintenance

With different maintenance and repair strategies required, the timing of individual maintenance tasks varies:

- Cleaning deck drains is performed when indications are that temperatures will be above freezing since water is normally used for this work.
- Cleaning of bridge decks is done by pick up broom during the spring. (Do not dump materials into waterways.)
- Patching or repairing minor concrete areas is performed when weather conditions permit cleaning, priming and placement of concrete or concrete patching material.
- Removing streambed vegetation from under or within 30 feet of a structure is performed in the fall when stream flow is at its lowest.
- Removing debris and drift materials deposited around piers should be completed as soon as possible.
- Repairing structural damage is performed as soon as practical, consistent with the severity of the damage.

Specialized Equipment

- Cement mixer
- Backhoe
- 15 # chipping hammer
- Bucket truck
- "Snooper" type man-lift truck
- Pick up broom/vacuum truck

- Attenuator mounted truck
- Sand blaster

Materials

- Rapid setting concrete patching materials.
- Portland cement concrete.
- Epoxy adhesive.
- Curing compound.
- Penetrating crack sealers.
- Reinforcing steel.
- Primer and paint products.
- Lubrication materials for bearing seats.
- Miscellaneous deck sealants.
- Miscellaneous hardware including various bolts, washers and nuts.

Ordering

Planned repairs are reviewed and an estimate of materials prepared. Arrangement for purchasing materials is made prior to scheduling the work.

Storage

Materials, such as paint, primer and rapid setting patch material, are stored indoors.

Special Handling

Epoxy adhesive used as a bonding agent between old and new concrete, the rapid setting patch product, curing compound and primer must be handled in accordance with the manufacturer's recommendations and the MSDS for that particular product.

Safety and Training

Supervisors should review safe, training and work zone requirements with employees and ensure compliance with approved guidelines. Employees should review material safety data sheets (MSDS) to learn about products used and to make themselves aware of safety and health precautions and the required personal protective equipment and clothing.

Special Precautions

When working with epoxy adhesives or rapid setting patch materials, employees are to comply with the recommended application temperatures and pot life of the mixed material.

Specialized training may be required for bridge repair. Consult with Bridge Maintenance Engineer.

Certification is required for snooper truck operation.

Because of environmental and structural concerns, maintenance does not paint steel structures.

Environmental Best Management Practices
Best management practices include:

- Placing refuse material above the bank, away from waterways and wetlands.
- Ensuring that the active flowing stream will not come into contact with fresh dissolvable concrete.
- Disposing of material in appropriate locations.
- Providing a stable, appropriate concrete truck chute clean-out area and requiring the contractor to use it to keep material from being deposited in riparian corridors.
- Using cofferdams for structural repairs as appropriate.
- Containing saw chips where feasible.
- Avoiding use of creosote or "Penta" treated wood for permanent structures.

To minimize and/or avoid environmental effects the following should be considered:

- Structural repair work that requires installation of riprap will consider use bioengineering solutions where practicable. "Practicable" use areas include areas unshaded by bridge elements above the full bank stage where success is probable and safety of the structure is assured.
- Structural repairs that require in-water work will be independently coordinated through the MDT Environmental Services District Biologist with MFWP to minimize impacts. These contacts will require significant modification of the aquatic system and thus require an ESA Biological Assessment and consultation with USFWS, The Army Corps of Engineers and tribes (where and when necessary) to divert water away from concrete work areas during structural repairs of bridges and culverts.
- Maintenance, when repairing drainage features, will make every attempt (within the engineering solution in coordination with the MDT Environmental District Biologist, MFWP Regional Biologist and/or MDT Hydraulics) to incorporate fish passage solutions and enhancement such as adding roughness (cobbles.)
- Maintenance will perform any in-water work with the SPA 124 permit in the water work window or in a time frame negotiated with MFWP.

Procedures

1. Obtain any required permits or access permissions.
2. Ensure that materials and required specialized equipment are available prior to starting work.
3. Set up traffic control devices, which may include arrow boards, changeable message signs, attenuator protection vehicles, and flaggers as appropriate for each specific job.
4. Perform required maintenance for specific job site during a time when weather conditions permit.
5. Clean up area.
6. Dispose of debris and material containers at appropriate disposal site.
7. Remove traffic control.

10.2 Inspection of Structures: Bridges and Culverts (MMS 4201)

Activity Description

This activity includes inspections of bridge approaches, expansion devices, decks, curbs, rails, beams, piers, pier caps, abutments, drainage systems and debris accumulations in all accessible areas. This also includes providing assistance to bridge inspection crews that may include providing traffic control, mobilization and /or operation of equipment. Also inspection of culverts, box culverts and similar drainage structures is done under this activity.

Purpose

Inspections to determine maintenance needs and prioritize deficiencies into two maintenance groups—urgent and routine. The routine group includes those in which there is no safety risk or risk of structure failure, and maintenance can be scheduled as labor, equipment and funding are available. The urgent group, which may affect the safety or the integrity of the structure, should be repaired as soon as possible.

Timing of Maintenance

Certified inspectors complete NBIS inspections at intervals not to exceed two years. Timber structures are more vulnerable to damage from traffic or natural events. Timber structures are to be inspected monthly. Other bridges are to be inspected semi-annually. Culverts should be inspected semi-annually, preferably after spring runoff, and prior to the winter season. Bridges or culverts should be inspected if they are involved in a major event such as an earthquake, flood or high water runoff event.
Based on inspections, it may be necessary to

- Clean immediately debris, sand, rocks, and silt from the structures to provide for the safe passage of traffic, or remove materials threatening the integrity of the structure.
- Clean immediately culverts that are plugged or schedule replacement for pipes that are threatened structurally by deterioration.
- Prioritize cleaning or repair of other structures or culverts based on funding availability and other maintenance priorities.
- Report damage to Bridge Maintenance Engineer, Helena, through the Area office.
- Schedule labor and equipment to assist in making structure repairs as recommended by the Bridge Maintenance Engineer.

Specialized Equipment

- Bucket Truck
- Snooper Truck
- Attenuator-mounted truck for sight protection
- Camera for documentation of damage

Safety and Training
Supervisors should review safety, training and work zone requirements with employees to ensure compliance with approved guidelines. Employees should review Material Safety Data Sheets (MSDS) to learn about products used and to make themselves aware of safety and health precautions and the required personal protective clothing and equipment.

Operators must be certified on snooper trucks.

Seasonal caution should be taken for snakes and varmints in culverts and under bridges.

Environmental Best Management Practices
Best management practices include:

- Placing refuse material above the bank, away from waterways and wetlands.
- Ensuring that the active flowing stream will not come into contact with fresh dissolvable concrete.
- Disposing of material in appropriate locations.
- Providing a stable, appropriate concrete truck chute clean-out area and requiring the contractor to use it to keep material from being deposited in riparian corridors.
- Using cofferdams for structural repairs as appropriate.
- Containing saw chips where feasible.
- Avoiding use of creosote or "Penta"-treated wood for permanent structures.

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- Maintenance will perform any in-water work with the SPA 124 permit in the water work window or in a time frame negotiated with MFWP.

Procedures

1. Inspect all structures and culverts.
2. Inspection of culverts should include checking for the following:
    - Culvert barrel to determine if it is plugged or partially plugged.
    - Cracks or joint separation in reinforced concrete pipe (RCP) culverts that might indicate structural concerns or erosion problems.
    - Soil erosion at the pipe inlets and outlets.
    - Drop inlets to ensure that they are not plugged.
    - Metal pipes for corrosion or distortion.

3. Inspections for structures should include checking for the following:
    - Damage from high, wide or overweight loads.
    - Loose bolts or other fasteners.
    - Incompressible materials in expansion joints.
    - Abnormal looseness or vibrating trusses.
    - Open cracks and significant spalling of concrete surfaces.
    - Accumulated dirt or debris at end supports, adjacent to bearings.
    - Plugged deck drains.
    - Accumulated debris such as dead trees hung up on piers.
    - Deterioration of concrete, particularly at the water line.
    - Trees or brush growing within 30 feet of each side of the structure that could cause debris to back up during times of high flows.
    - Vegetation that could cause sight distance problems.
    - Broken curbs, wings, and rails.
    - Scouring around piers and abutments.

Questions on structure-related problems should be forwarded to the Bridge Maintenance Engineer through the Area office.

In addition to MMS documentation, each supervisor should maintain documentation of culvert and bridge inspections in the daily diary. NBIS inspections results are documented on the Assessment Form for Structures and copies are sent to Area office.